Day / /

Biochemistry

lecture - 3

* **Polysaccharides :-** Are polymers of more than 10 units of monosaccharides

They are classified into :-

① - Homopolysaccharides ② - Heteropolysaccharides

I - Homopolysaccharides :-

are polysaccharides consist of one type of monosaccharides units.

Note :- All Homopolysaccharides are (polymers of glucose)

except :- ① Agar (polymer of galactose.)

② Inulin (polymer of fructose.)

Note :- - Any digested sugar gives → energy.

- Any undigested sugar gives → diatery fibers

Examples of Homopolysaccharides :-

a) Starch.
b) Glycogen.
c) cellulose.
d) Inulin.
f) Dextrins.
f) Dextran.
h) Agar.

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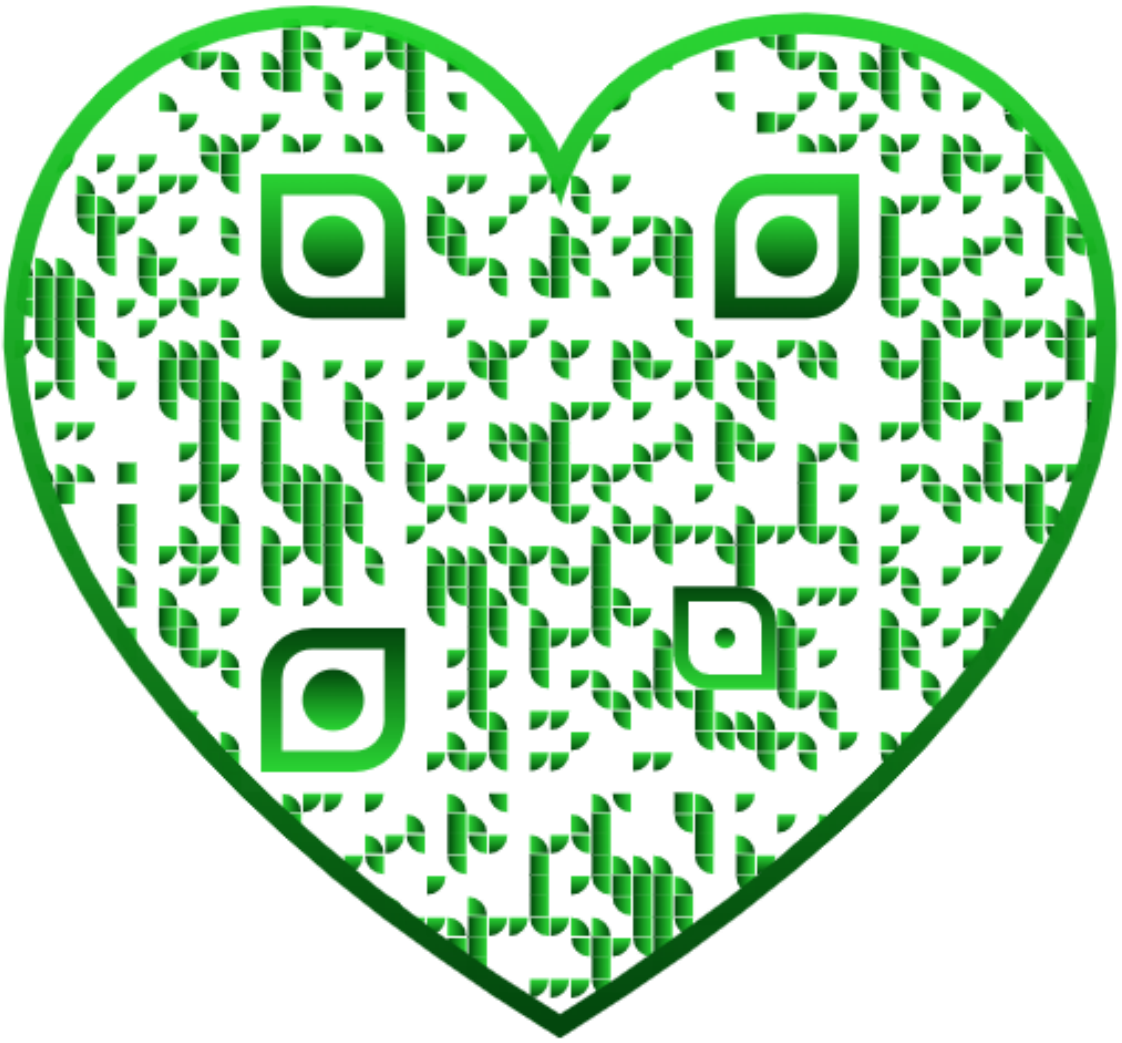

a) Starch :-

- Composition :- polymer of glucose
- Importance:- most important food source of carbohydrates for human.
- produced by all green plants.
- Starch ha two polysaccharides :-
  1. Amylose :- 15-20% Starch (unbranched)
  2. Amylopectin:- 80-85% Starch (branched.
- properties of Starch :-
  1- It's white, tasteless and odorless powder.
  2- Insoluble in cold water.
  3- Give blue color with Iodine test (متفرع)

Branched ⟶ (gives a color) = إي سكر متفرع يعطي لون
Unbranced ⟶ (No color) = وإي سكر غير متفرع لا يعطي لون

b) Glycogen :-

- Composition:- polymer of glucose.
- it's the major form of storage polysaccharides
- It is found mainly in liver (10% of liver mass) and Skeletal muscle (1-2% of muscle mass.)
- it's digested ⟶ gives energy
- Gives red color with Iodine test
- It takes up small amount of space

(properties)

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Note:-
- Dental palque is rich with (Dextran)

c) Cellulose :-
- Composition:- (polymer of Glucose)
- Importance:- laxative and prevent Cholesteral (معالج الإمساك ← لا يهضم)
- properties:- 1- tastless and odourless.
2- insoluble in water and most organic solvent.
3- Structural material of plant. ← العمود الفقري للنبات
4- gives no color with iodine

d) Inuline:-
- Composition:- (polymer of fructose)
- found in:- onion, garlic and some root plants.
- Importance:- 1- measure renal function and acts as prebiotes

e) Dextrin:- → لا يوجد بالطبيعة ولكن توجد أثناء هضم النشا
- Composition:- (polymer of glucose.) and used in envelope adhesives
- function:- used in infant feeding (مثل الحليب المتوفر في الصيدليات), gives in postag stamps (صمغ) ↑

f) Dextran:- Note ⟹ synthesized by sucrose by certain bacteria.
- Composition:- (polymer of glucose)
- Importance / function:- ① used as plasma expande (الحفاظ على ضغط الدم) (increase blood volume) when given IV, ② hemorrhage, ③ prevent thrombosis. (يستخدم في العمليات لمنع التخثر)

g) Agar:- (polymer of galactose) ↓ نزيف
- Composition:- ↑↑
- function:- ① laxative (مسهل), ② preparation of bacterial and fungi culture media (تحضير وسط بكتيري أو فطري), ③ electrophoretic seperation.

فصل الكهربائي: فصل الـ DNA.
- glucose.
- protien.

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2- Heteropolysaccharides :-

is a polymer consisting of two or more different monosaccharides.

* it is 3 types (ثلاث أنواع) :-

1) Glycosaminoglycan. (or mucopolysaccharides GAG)
   - consist of 2 units:
     - a) Acidic sugar. سكر حامضي
     - b) amino sugar سكر أميني

2) proteoglycans.

3) Glycoprotein.

- first type:- [Glycosaminoglycan] = Mucopolysaccharides GAG.

(1) - consist of two units:- (1) Acidic sugar (2) amino sugar.
(يتكون من وحدتين) سكر حامضي سكر أميني

(2) - the function:- Resilience (resistance to pressure) (الوظيفة)
, Flexibility of the body. (المرونة)

Note:- Glycosaminoglycan موجود في غضاريف العين والمفاصل والرئة والأوعية الدموية (أي مكان في الجسم فيه مرونة) وتمتص الضربات وتقاومها.

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3- Classification of glycosaminoglycan :-

1- Hyaluronic acid :- (hyalo → means glass)

1- Non sulfated GAG

2- Composition :- a-) glucuronic acid (سكر حامضي) , b-) N-acetylglucosamine (سكر أميني)

3- Found in :- - Synovial fluid of the joints (most abundant)
- Vitreous humor of the eye.
- Connective tissue & skin

4- Function :- 1) lubricant in joints
2) Responsible for resilience of Cartilage.
3) involved in tissue repair.
4) role in movement and proliferation of cells.

2- Chondroitin Sulphate A and C :-

1- Found in :- Cartilage, Cornea of eye, tendon, ligaments bones and Connective tissue matrix.

2- Sulfated glycosaminoglycan.

3- Composition :- repeating sugars (① glucuronic acid and ② N-acetyl galactosamine).

4- function :- 1) Important component of cartilage.
2) dietary supplement for treatment of osteoarthritis

ملاحظة :- والـ Condratin لها نوعان :-

① Condratin (A) :- إذا أتصل الكبريت بكربون رقم (4)

② Chondrotin (C) ← (6) اذا اتصل الكبريت بكربون رقم

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(Keras → means horn)

[3]- Keratan Sulfate : (Not Keratin) :

1) found in Cornea (1-), Cartilage (2-) and Intervertebral disk (3-).

2) function : 1) Act as cushion to absorb mechanical shock
Importance
2) Corneal transparency.

[4]- Dermatan Sulfate : (derma → means : Skin)

1) Found : mostly in Skin, also blood vessels, heart valves, tendons & lungs.

2) Consist of a repeating disaccharides units of
1-) idouronic acid (سكر حامضي) , 2) N-acetylglucosamine (سكر أميني)

3) functions- 1) [illegible] repair, 2) anticoagulant (Heparin)
3) resistance to infectious disease.

[5]- Heparin :- (α-heparin)

1) produced by (mast cells) of liver, kidney, lungs and Skin.

2) functions-) 1- anti coagulant.
2- Clear lipids from plasma.

3) Rich in sulphate

(hepar → means liver)

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- Second type : [proteoglycan] :-

1) Composition :- 95% carbohydrates, 5% protein.
- type of carbohydrate : [glycosaminoglycan]

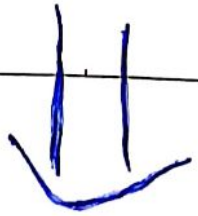
2) found :- a) connective tissue, b) aggrecan (large proteoglycan)
c) cartilage.

3) function :- a) provide elasticity and support to tissue.
b) Act as a barrier in tissues.
c) lubricant in joints

- Third type :- [Glycoprotein] :- = (mucoproteins).

1) Composition :- ① 1-85% carbohydrates.
② 15-99% protein.
- type of carbohydrates :- [oligosaccharide]

2) functions :- see page 48



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Function

1-Act as metal-transport proteins (transferin).

2-Act as a component of the blood clotting factors.

3-Many enzymes are glycoprotein (RNase).

4-Act as lubricant and protective agent (mucins).

5-Act as a component of some hormones (TSH).

6-Act as a component of structural molecule (collagens).

7-Act as a component of immunoglobulins (antibodies).

8-Act as a component of the ABO blood group substances.

9-Act as cell receptors.

Table 1.2 Different between proteoglycans and glycoproteins

	Proteoglycans	Glycoproteins
Carbohydrate content	95 % (higher)	1-85 % (lower)
	Glycosaminoglycans	Many Oligosaccharides
	unbranched	branched
Presence of sulfate and uronic acid	Present	Absent
Protein content	5%	15-99%

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